C
M58uZ6is
1911.

THE LIBRARY
OF THE
UNIVERSITY OF ILLINOIS

UNIVERSITY BULLETIN

NEW SERIES, VOL. XII, NO. 9. MARCH, 1911

UNIVERSITY OF MICHIGAN
SUMMER SESSION

ANNOUNCEMENT

FOR THE

BIOLOGICAL STATION

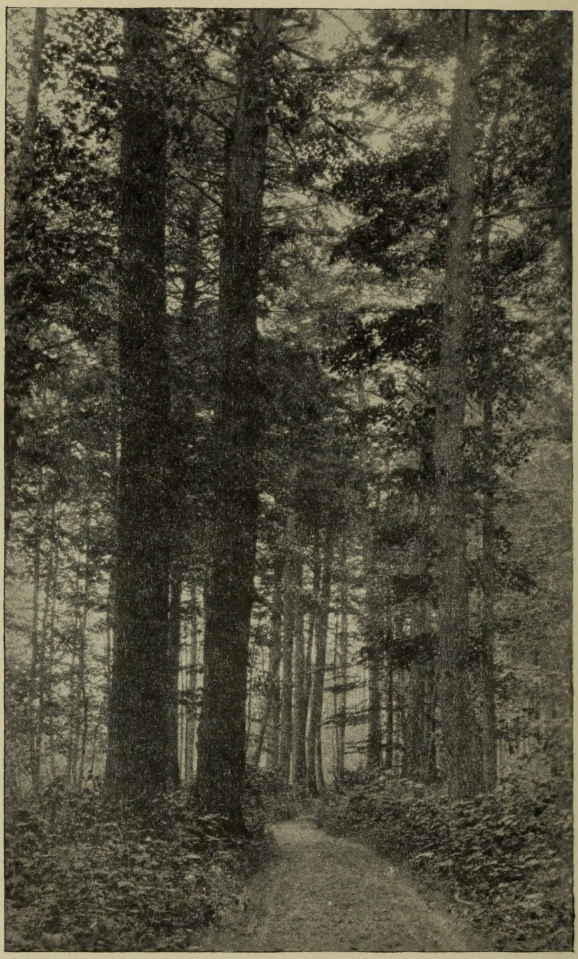
EIGHT WEEKS, JULY 3—AUGUST 25

THIRD SEASON, 1911

MAY 15 1911

Ann Arbor
PUBLISHED BY THE UNIVERSITY
1911

SHOUT
SHARE
IT



AMONG THE BIG TREES.

THE BIOLOGICAL STATION OF THE UNIVERSITY OF MICHIGAN

A Station for Instruction and Research in Biology will be maintained by the University of Michigan, for the third season, as a part of its regular Summer Session, during the eight weeks from July 3 to August 25 inclusive, 1911.

LOCATION.

The Station will be located near the Bogardus Engineering Camp of the University on a tract of about 1,666 acres of land owned by the University and stretching from Douglas Lake to Burt Lake in Cheboygan County, Michigan, 17 miles south of the Straits of Mackinac. This region, diversified by hills and valleys, was formerly covered by primeval forest, and vestiges of this still remain. It contains many lakes of clear water, unsurpassed in the state for size, depth and beauty of setting. The elevation of the camp, between two and three hundred feet above Lake Michigan, insures cool nights and makes the location favorable for hay fever sufferers.

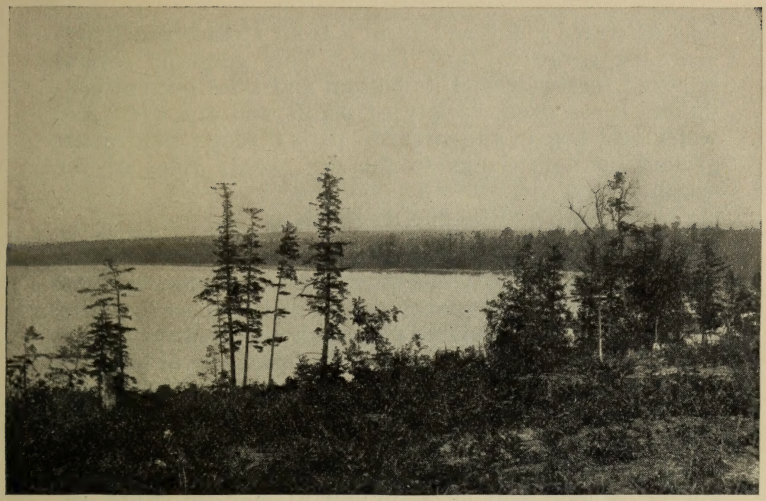
Six miles to the west of the camp on the Grand Rapids and Indiana Railway is the nearest railway station, Pellston, a town of some 1,300 inhabitants with a bank and a variety of retail establishments. Fifteen miles to the northeast is Cheboygan on the Michigan Central Railway. A state road connects these points and passes near the station. Except for two small summer resorts on Douglas Lake the region for miles about is almost uninhabitated. Douglas Lake is two and one-half miles wide and nearly four miles long. Its shores are everywhere wooded, in some places low and receding, in others rising in terraced bluffs 70 feet above the lake. The shore is of

clean sand and the sandy lake bottom slopes gradually into deep water, affording ideal conditions for bathing and boating.

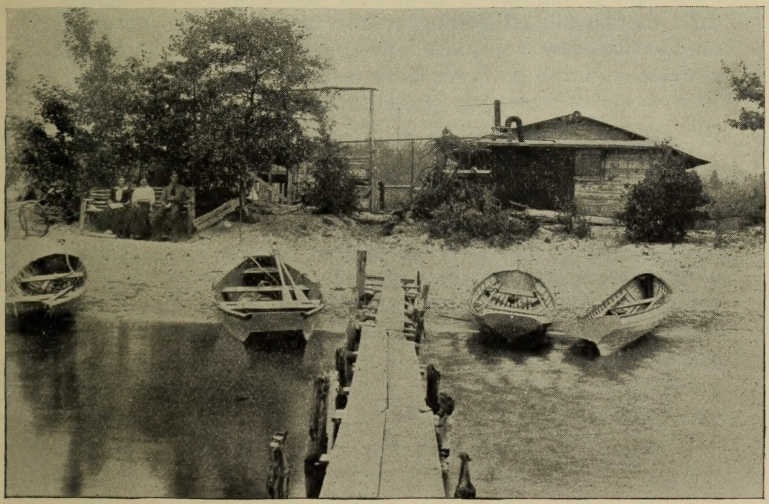
The Bogardus Camp lies in the center of a circle of the famous summer resorts of northern Michgan. In clear view from the highest terrace of Bogardus Camp and a mile and a half to the south is Burt Lake, much larger than Douglas Lake and one of the chain of lakes and rivers which form the celebrated "Inland Route" from Petoskey on Lake Michigan to Cheboygan on Lake Huron. Thousands of tourists traverse this route every summer and are charmed as the little steamer which carries them passes alternately through narrow, tortuous streams and broad stretches of open lake. Of the summer resorts on the Inland Route, Topinabee on Mullet Lake is best known and is in summer a station of the Michigan Central Railway 8 miles from Bogardus Camp; all mail for the station should be directed to this place.

A drive of 12 miles from Bogardus Camp to the west over the state road brings one to the resort region of Petoskey, Bay View, Harbor Springs and Harbor Point on Little Traverse Bay, while some 20 miles west of Petoskey is Charlevoix on Lake Michigan. Seventeen miles north of Pellston on the Straits of Mackinac is Mackinaw City, from which a ferry runs seven miles to Mackinac Island, in historical association and scenic beauty the gem of the Great Lakes region.

The topography of the region immediately about the Bogardus Camp is such as to afford a variety of floral and faunal conditions. The region is characteristically sandy and the home of the ground pines, wintergreen and trailing arbutus, but there are areas of broad leaf trees and shrubs with their usual accompaniments in flora and fauna. Deer, and foxes occur in the neighborhood. Among forms of especial interest to Zoölogists may be mentioned Lota (the fresh water codfish), Necturus (the mud puppy), the bald eagle and the ant-lion. A half mile south of the camp is a remarkable gorge which ends abruptly against a bluff some seventy feet high. From the bottom of the bluff there issue numerous springs which yield more than a million gal-



DOUGLAS LAKE FROM THE BLUFF, BIOLOGICAL STATION AT THE RIGHT.



ONE OF THE LABORATORIES.

lons of water a day and form a trout stream which follows the gorge to Burt Lake. This gorge is several hundred feet wide and its bottom and sides present conditions for a great variety of plants and animals, from water and bog in the stream's path through rich, moist ground on both flanks to the dry, sandy sides of the ascent.

PLAN OF WORK.

It is not the purpose of the station to duplicate the work offered at the University, but to provide facilities for field work of a sort that cannot be so well carried on under urban conditions or with the limitations imposed by a university schedule. Instruction will be limited to the courses announced, but qualified students may arrange to follow other lines by electing the special courses. A student may give his entire time to either botany or zoölogy or may divide it between these subjects, but no student will be permitted to take the work for more than eight hours University credit. Each of the four-hour courses is planned to take one-half the student's time, the two-hour courses, one-quarter; the special courses may take any part or the whole of the time. Although a regular schedule of work will be adopted, this will be varied whenever the nature of the material or the weather conditions make this advisable. In all courses at least half the time will be spent in the field. The work of research students will be arranged in accordance with the nature of the problem selected.

FACILITIES FOR INSTRUCTION.

The necessary scientific equipment for field and laboratory work, a launch, row-boats, collecting apparatus, nets, traps, cameras, field glasses, microscopes and accessories, and books are provided by the University. Indoor work will be done in a substantial log building and a tent laboratory.

GRADUATE WORK.

Graduate students, who are regularly matriculated in the University and properly registered with the Secretary

of the Graduate School may carry on work at the station which will count toward an advanced degree.

For full information concerning the requirements for advanced degrees, address the Secretary of the Graduate School, Ann Arbor, Mich.

BOARD AND LODGING.

Tents for the use of students and teaching staff will be pitched near the Bogardus Camp. Mrs. Frank Smith will have general supervision of the women's quarters, and will be ready at any time to advise women students. Each tent, 14 x 14 ft., accommodates four persons and is covered by a fly, provided with a wooden floor and equipped with a stove, mosquito bed-canopy, pail, tub, washstand, pitcher, bowl, table, chairs and camp couches, or straw-filled bed ticks. Students will provide their own towels and bedding, and those who prefer to do so may bring their own tents. All tents must be pitched in accordance with the regulations of the Bogardus Camp and will be subject to daily inspection.

First class table board will be provided at the Dining Hall of the Bogardus Camp, and students will not be permitted to cook their own meals.

A list of the articles of clothing, bedding and other necessities for the work with instructions for reaching the camp and directions concerning registration and the payment of fees, will be sent in due time to those students who are accepted.

FEES AND EXPENSES.

Students, except as below, will pay the regular Summer Session fee of $20.00 for the eight weeks and will then be entitled to take courses aggregating eight hours university credit, and to use the scientific equipment. A charge of $2.00 per week will be made to those students who use the tents provided by the station. Students may, however, provide their own camp equipment, of such sort as they may choose. Board at the Bogardus Camp Dining Hall will cost about $4.00 per week.

Students not graduates of the University of Michigan

who enroll in the Graduate School will pay, in place of the above fee of $20.00, a fee of $25.00. This fee of $25.00 includes the regular matriculation fee of the University and the fee for the current summer.

Low round-trip rates from any point in the United States to Pellston may be purchased over all railroads and are good for the summer season. The round-trip rate from Ann Arbor to Pellston is $7.80.

REGISTRATION.

Since the number of students that can be accommodated is limited, *immediate registration is necessary to insure admission and no registration will be accepted if received after June first.* Applications for admission should be addressed to Professor Charles P. Wagner, Secretary of the Summer Session, Ann Arbor, Mich., and should indicate the courses that the student intends to pursue, his preparation for them, and whether he will bring his own camp equipment or use that provided by the station.

STAFF OF INSTRUCTION.

JACOB REIGHARD, PH.B., *Professor of Zoölogy and Director of the Zoölogical Laboratory and the Zoölogical Museum in the University of Michigan, Director of the Biological Station and Professor of Zoölogy.*

FRANK SMITH, A.M., *Associate Professor of Zoölogy in the University of Illinois, Assistant Professor of Zoölogy.*

HENRY ALLAN GLEASON, PH.D., *Assistant Professor of Botany in the University of Michigan, Assistant Professor of Botany.*

FRED AARON LOEW, B.S., *Professor of Science in Central College (Indiana), Assistant in Botany.*

HORACE BURRINGTON BAKER, A.B., *Assistant in Zoölogy in the University of Michigan, Assistant in Zoölogy.*

DORA STAMATS SMITH, PH.B., *Women's Adviser.*

A CLASS IN THE FIELD.

OFF FOR THE DAY.

1. *The Natural History of Vertebrate Animals, with special reference to behavior and evolution.* The fishes, amphibians, reptiles, birds and mammals of the region will be collected and identified and as far as possible their habits will be studied in the field and laboratory. Students will thus learn to recognize the native vertebrates at sight. In the field special attention will be given to methods of work. The exact methods of the laboratory, not hitherto commonly used in the field, will be applied to the observation of animal habits and to the making of field records, both written and pictorial. Photography will be used whenever possible both for terrestrial and aquatic forms. The records made in the field will form the basis of written reports, reading will be required and conferences will be held for the discussion of the relation of the observations to the general problems of animal behavior and evolution.

The attempt will be made to give to teachers and others a certain measure of that intimacy with living animals out of doors that forms the charm of Thoreau and Burroughs. At the same time modern methods of observation, record and interpretation will be utilized for scientific ends. Two half days of field or laboratory work and one conference weekly. *Two hours credit.* PROFESSOR REIGHARD.

2. *The Natural History of Invertebrate Animals.*— The protozoans, sponges, coelenterates, rotifers, bryozoans, worms, crustaceans, spiders, myriapods, insects and molluscs of the region wll be studied. Both aquatic and terrestrial invertebrate animals will be collected and identified, so that students will gain a general familiarity with them and learn to recognize the common species at sight. Especial attention will be given to exact methods of field observations and to the making of field records. The principles of fresh water biology will be studied, and practice will be given in the use of such apparatus as plankton pumps and nets, the thermophone, thermometer, turbidimiter and centrifuge. The field work will be supplemented by a more detailed examination of ani-

mals in the laboratory; here the structural adaptations which make certain organisms suited to particular habitats will be studied. The records made in the field will form the basis for written reports, and reading will be required. In the conferences, the relation of observations to general problems will be discussed.

This course will attempt to give an intimate knowledge of out door life, to make one at home with invertebrates in the field. Exact methods will be used in making observations, and an effort will be made to correlate the facts observed with the general principles of biology. Four half days of field or laboratory work, and one or two hours devoted to conference or lecture weekly. *Four hours credit.* Assistant Professor Smith.

3. *The Natural History of Birds.*—Birds will be studied with especial reference to their environment. Field work will include identification, observations on habitat preferences, food habits, nesting activities and the early autumnal migration movements. In the conferences attention will be given to the economic relations of birds to man, their seasonal distribution and the facts and theories of their annual migration movements. The bird fauna is abundant and includes many representatives of northern species. Two half days of field work and one conference weekly. *Two hours credit.* Assistant Professor Smith.

4. *The Natural History of Molluscs.*—The molluscs of the region will be collected and identified and field studies made of their relations to environment and their meaning in the biology of the region. An opportunity will be afforded to become familiar with the literature of systematic conchology and to form individual collections of properly determined specimens. Such collections should be of great value to teachers. Two half days of field work and one conference weekly. *Two hours credit.* Mr. Baker.

5. *Individual Course. Special and Research Work in Evolution and Behavior.*—This course does not involve

formal instruction but is intended for those who wish to take up special work or to do research under direction. Studies may be made in animal behavior, in the meaning of color in its relation to environment, in mimicry and the like. A number of problems in these fields have been already outlined and are awaiting solution. *Two, four, six or eight hours.* PROFESSOR REIGHARD.

6. *Systematic and Faunal Zoölogy.*—The identification and classification of special groups of animals and their distribution in the Douglas Lake Region.

a. *The Fishes.* PROFESSOR REIGHARD.

b. *The Oligochetes.* ASSISTANT PROFESSOR SMITH.

c. *The Molluscs.* MR. BAKER.

Two, four, six or eight hours credit.

Those having special problems that they wish to investigate should communicate with the Director of the Station concerning literature, apparatus and material.

BOTANY.

1. *Field and Forest Botany.*—This course will be made of especial interest to those students who desire an acquaintance with the life and habits of plants in their natural surroundings, and with the correlation between the environment and the structure of the plant. The work will consist of field trips, laboratory exercises, and lectures. In the field the student will become familiar with the commoner trees, herbaceous plants and ferns of the vicinity, and with the plant associations in which they grow. The various factors influencing the distribution of plants and their grouping into definite associations will be considered as fully as the time will allow. The effect on the vegetation of certain external factors, such as the water content of the soil, the topography, and the light, will be studied. The topography of the region is so varied that a wide range in ecological factors is produced, and consequently a large number of habitats with varied flora is available for study. In the laboratory, a study will be made of the structure of some plants

of the region, with chief attention to the relation between the form of the plant and the environment in which it lives. The lectures will consist of a presentation of the general principles of plant ecology, as illustrated in the vegetation of the vicinity. Four half days work in the field or laboratory and one conference weekly. *Four hours credit.*. Assistant Professor Gleason, Mr. Loew.

2. *Systematic Botany.*—The chief aim of this course is to acquaint the student with the flora about the camp. The general principles of the classification of the higher plants will be considered with special reference to the local flora. The flora is very rich in species and family types. There is an excellent opportunity for the collection and preparation of material for the herbarium. It is desired that students electing this course should have some previous experience, however slight, in the identification of plants. Two half days field work and one conference weekly. *Two hours credit.* Assistant Professor Gleason.

3. *Individual Course*: *Special and Research Work.*—Students who have taken either of the two preceding courses, or their equivalent, will find at the station excellent opportunities for further study or research in many lines of botany. In every case students will receive individual direction and assistance as needed, and the nature of the work will be adapted to the personal need of the student. For the graduate, conditions are very favorable for study or research in various lines of ecology. For the undergraduate, there is a wide range of available subjects for study, sufficient to meet the individual tastes of every student. *Two, four, six, or eight hours credit.* Assistant Professor Gleason.

PHOTOGRAPHY.

While there will be no regular instruction in photography, a well equipped dark room is provided and all students will be given such individual assistance as they may

need.. The station is provided with a camera of the usual form, a reflecting camera and a unique apparatus for sub-aquatic photography. Although students may use the station apparatus for scientific purposes, they should bring their own cameras for other uses. Those exceeding 5 x 7 size are not suitable for the field and the best size is probably 4 x 5. Daylight developing outfits for films are to be preferred.

NATURE STUDY.

While no formal instruction will be given in the subject matter or methods of nature study, it is the purpose of the work to bring the student into the closest possible contact with out-door nature. It is believed that teachers of nature study will find this the best preparation.

PUBLICATION.

The instruction offered is along the lines of the published researches of the members of the teaching staff and students will receive every encouragement to take up work that may yield results suitable for publication. Every assistance will be given in preparing matter for publication and in placing it in suitable scientific journals.

EXCURSIONS.

Saturday excursions may be arranged to the points of scientific, historical, and scenic interest that lie on every side. Such excursions afford opportunities to the student to broaden his knowledge of natural history and to collect natural history objects. Excursions to nearer points by boat and on foot will form a regular part of the work of the station. Week-end camping trips will be arranged during which informal instruction in camping and woodcraft will be given. These are arts useful in many natural history investigations.

RECREATION.

Recreation will not be permitted to interfere with the regular work of the Station, but when the day's work is

done, opportunities for boating, swimming and fishing are to be found on every side. Those who wish will be given instruction in swimming and boating. The location of the station in the midst of the northern wilderness and within the circle of Northern Michigan resorts makes it possible to *combine with study the pleasures of a summer outing in an invigorating climate.* At the close of each of the previous sessions every student testified that, while he had gained in his studies as much as would have been possible at a regular university seat, he had at the same time improved in health. Many who had come to the station jaded by a year of teaching left it as much rested as though they had given the whole time to recreation alone.

The University Bulletin is Issued by the University of Michigan as Often as Every Six Weeks During the University Year.

Entered as Second-Class Matter at the Postoffice at Ann Arbor, Michigan.

The Bulletin Includes the Following Publications:—

The Annual Report of the President.

The Calendar of the University.

The Annual Announcements of the Department of Literature, Science, and the Arts, the Graduate School, the Departments of Engineering, of Medicine and Surgery, and of Law, the School of Pharmacy, the Homœopathic Medical College, the College of Dental Surgery, and the Summer Session.

Other Announcements of the several departments of instruction, Reports of University officers, etc.

The Ann Arbor Press

C
M58 ser 6
1912

THE LIBRARY
OF THE
UNIVERSITY OF ILLINOIS

UNIVERSITY BULLETIN
NEW SERIES, VOL. XIII, NO. 16. MARCH, 1912

UNIVERSITY OF MICHIGAN
SUMMER SESSION

ANNOUNCEMENT

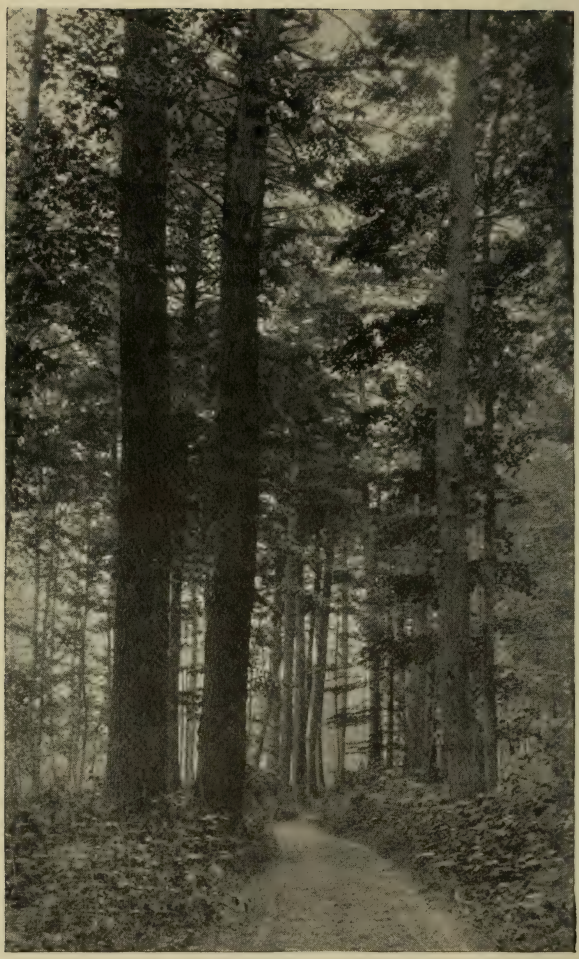
FOR THE

BIOLOGICAL STATION

EIGHT WEEKS, JULY 2—AUGUST 23

FOURTH SEASON, 1912

Ann Arbor
PUBLISHED BY THE UNIVERSITY
1912



AMONG THE BIG TREES.

THE BIOLOGICAL STATION OF THE UNIVERSITY OF MICHIGAN

A Station for Instruction and Research in Biology will be maintained by the University of Michigan, for the fourth season, as a part of its regular Summer Session, during the eight weeks from July 2 to August 23 inclusive, 1912.

LOCATION.

The Station will be located near the Bogardus Engineering Camp of the University on a tract of about 1,666 acres of land owned by the University and stretching from Douglas Lake to Burt Lake in Cheboygan County, Michigan, 17 miles south of the Straits of Mackinac. This region, diversified by hills and valleys, was formerly covered by forests of hardwoods and conifers. Small tracts of the former still remain. It contains many lakes of clear water, unsurpassed in the state for size, depth, and beauty of setting. The elevation of the camp, between one and two hundred feet above Lake Michigan, insures cool nights and makes the location favorable for hay fever sufferers.

Six miles to the west of the camp on the Grand Rapids and Indiana Railway is the nearest railway station, Pellston, a town of some 1,300 inhabitants with a bank and a variety of retail establishments. Fifteen miles to the northeast is Cheboygan on the Michigan Central Railway. A state road connects these points and passes near the station. Except for two small summer resorts on Douglas Lake the region for miles about is almost uninhabited. Douglas Lake is two and one-half miles wide and nearly four miles long. Its shores are everywhere wooded, in some places low and receding, in others rising in terraced bluffs 70 feet above the lake. The beach is of clean sand and the sandy lake bottom slopes gradually into deep water, affording ideal conditions for bathing and boating.

The Biological Station lies in the centre of a circle of the famous summer resorts of northern Michigan. In clear view from the highest terrace of the Station and a mile and a half to the south is Burt Lake, much larger than Douglas Lake and one of the chain of lakes and rivers which form the celebrated "Inland Route" from Petoskey on Lake Michigan to Cheboygan on Lake Huron. Thousands of tourists traverse this route every summer and are charmed as the little steamer which carries them passes alternately through narrow, tortuous streams and broad stretches of open lake. Of the summer resorts on the Inland Route, Topinabee on Mullet Lake is best known and is a station of the Michigan Central Railway 8 miles from the Station.

A drive of 12 miles from the camp to the west over the state road brings one to the resort region of Petoskey, Bay View, Harbor Springs, and Harbor Point on Little Traverse Bay, while some 20 miles west of Petoskey is Charlevoix on Lake Michigan. Seventeen miles north of Pellston on the Straits of Mackinac is Mackinaw City, from which a ferry runs seven miles to Mackinac Island, in historical association and scenic beauty the gem of the Great Lakes region.

The topography of the region immediately about the Station is such as to afford a variety of floral and faunal conditions. The region is characteristically sandy and the home of the ground pines, wintergreen, and trailing arbutus, but there are areas of broad-leaf trees and shrubs with their usual accompaniments in flora and fauna. Deer and foxes occur in the neighborhood. Among forms of especial interest to Zoölogists may be mentioned Lota (the fresh water codfish), Necturus (the mud puppy), the bald eagle, and the ant-lion. A half mile south of the camp is a remarkable gorge which ends abruptly against a bluff some seventy feet high. From the bottom of the bluff there issue numerous springs which yield more than a million gallons of water a day and form a trout stream which follows the gorge to Burt Lake. This gorge is several hundred feet wide and its bottom and sides present conditions for a great variety of plants and animals, from

DOUGLAS LAKE FROM THE BLUFF, BIOLOGICAL STATION AT THE RIGHT.

ONE OF THE LABORATORIES.

water and bog in the stream's path through rich, moist grounds on both flanks to the dry, sandy sides of the ascent.

PLAN OF WORK

It is not the purpose of the Station to duplicate the work offered at the University, but to provide facilities for field work of a sort that cannot be so well carried on under urban conditions or with the limitations imposed by a university schedule. Instruction will be limited to the courses announced, but qualified students may arrange to follow other lines by electing the special courses. A student may give his entire time to either botany or zoölogy or may divide it between these subjects, but no student will be permitted to take the work for more than eight hours University credit. Each of the four-hour courses is planned to take one-half the student's time, the two-hour courses, one-quarter; the special courses may take any part or the whole of the time. Although a regular schedule of work will be adopted, this will be varied whenever the nature of the material or the weather conditions make this advisable. In all courses at least half the time will be spent in the field. The work of research students will be arranged in accordance with the nature of the problem selected.

FACILITIES FOR INSTRUCTION.

The necessary scientific equipment for field and laboratory work, launches, row-boats, collecting apparatus, nets, traps, cameras, field glasses, microscopes and accessories, and books are provided by the University. For indoor work there are two log buildings and a tent laboratory.

GRADUATE WORK.

Graduate students, when regularly matriculated in the University and properly registered with the Secretary of the Graduate School, may carry on work at the Station which will count toward an advanced degree.

For full information concerning the requirements for advanced degrees, address the Secretary of the Graduate School, Ann Arbor, Mich.

BOARD AND LODGING.

Tents for the use of students and teaching staff will be pitched near the Bogardus Camp. Mrs. Anna M. Rhoades, Dean of Women, will have general supervision of the women's quarters, and will be ready at any time to advise women students. Each tent, 14 x 14 ft., accommodates four persons and is covered by a fly, provided with a wooden floor and equipped with a stove, mosquito bed-canopies, pail, tub, washstand, pitcher, bowl, table chairs, and straw-filled bed ticks. Students will provide their own towels and bedding, and those who prefer to do so may bring their own tents. All tents must be pitched in accordance with the regulations of the Bogardus Camp and will be subject to daily inspection.

First-class table board will be provided at the Mess Tent of the Bogardus Camp, and students will not be permitted to cook their own meals.

A list of the articles of clothing, bedding, and other necessities for the work, with instructions for reaching the camp and directions concerning registration and the payment of fees, will be sent in due time to those students who are accepted.

FEES AND EXPENSES.

Students, except as below, will pay the regular Summer Session fee of $20.00 for the eight weeks and will then be entitled to take courses aggregating eight hours university credit. A charge of $8.00 is made for the use of the scientific equipment. A further charge of $8.00 is made to those students who use the tents provided by the Station. Students may, however, provide their own camp equipment, of such sort as they may choose. Board at the Bogardus Camp Mess Tent is provided at cost, about $4.00 per week.

Students not graduates of the University of Michigan who enroll in the Graduate School will pay, in place of the above fee of $20.00, a fee of $25.00. This fee of $25.00 includes the regular matriculation fee of the University and the fee for the current summer.

Low round-trip rates from any point in the United States to Pellston or Mackinac Island may be purchased

over all railroads and are good for the summer season. The round-trip rate from Ann Arbor to Pellston is $7.80.

REGISTRATION.

Since the number of students that can be accommodated is limited, *immediate registration is necessary to insure admission and no registration will be accepted if received after June first.* Applications for admission should be addressed to Professor T. E. Rankin, Secretary of the Summer Session, Ann Arbor, Mich., and should indicate the courses that the student intends to pursue, his preparation for them, and whether he will bring his own camp equipment or use that provided by the Station.

STAFF OF INSTRUCTION.

JACOB REIGHARD, PH.B., *Professor of Zoölogy and Director of the Zoölogical Laboratory and the Zoölogical Museum in the University of Michigan, Director of the Biological Station and Professor of Zoölogy.*

FRANK SMITH, A.M., *Associate Professor of Zoölogy in the University of Illinois, Assistant Professor of Zoölogy.*

HENRY ALLAN GLEASON, PH.D., *Assistant Professor of Botany in the University of Michigan, Assistant Professor of Botany.*

AARON FRANKLIN SHULL, PH.D., *Instructor in Zoölogy in the University of Michigan, Research Assistant in Zoölogy.*

ROLAND MCMILLAN HARPER, PH.D., *Research Assistant in Botany.*

FRED AARON LOEW, B.S., *Professor of Science in Central College (Indiana), Assistant in Botany.*

ARTHUR GIBSON VESTAL, A.B., *Instructor in Biology, University of Colorado, Assistant in Botany.*

JOHN SMITH DEXTER, A.M., *Professor of Biology, Northland College, Ashland, Wisconsin, Assistant in Orinthology.*

PAUL SMITH WELCH, A.B., *Fellow in Zoölogy, University of Illinois, Assistant in Entomology.*

FRANCES J. DUNBAR, B.S., *Assistant in Zoölogy, University of Michigan, Assistant in Zoölogy.*

ANNA MINER RHOADES, *Dean of Women.*

A CLASS IN THE FIELD.

OFF FOR THE DAY.

1. *The Natural History of Vertebrate Animals, with special reference to behavior and evolution.* The course will deal chiefly with fishes, amphibians, and mammals, but not with birds (see Course 3), and only incidentally with reptiles. As far as possible the forms occurring in the region will be collected and identified and their habits studied in the field and laboratory. Students will thus learn to recognize many of the native vertebrates at sight. In the field special attention will be given to methods of work. The exact methods of the laboratory, not hitherto commonly used in the field, will be applied to the observation of animal habits and to the making of field records, both written and pictorial. The records made in the field will form the basis of written reports, reading will be required, and conferences will be held for the discussion of the relation of the observations to the general problems of animal behavior and evolution.

The attempt will be made to give to teachers and others a certain measure of that intimacy with living animals out of doors that forms the charm of Thoreau and Burroughs. At the same time precise methods of observation, record, and interpretation will be utilized for scientific ends. Two half days of field or laboratory work and one conference weekly. *Two hours credit.* PROFESSOR REIGHARD.

2. *The Natural History of Invertebrate Animals.*— The protozoans, sponges, coelenterates, rotifers, bryozoans, worms, crustaceans, and molluscs of the region will be studied. Both aquatic and terrestial invertebrate animals will be collected and identified, so that students will gain a general familiarity with them and learn to recognize the common species at sight. Especial attention will be given to exact methods of field observations and to the making of field records. The principles of fresh water biology will be studied, and practice will be given in the use of such apparatus as plankton pumps and nets, the thermophone, thermometer and turbidimeter. The field work will be supplemented by a more detailed examination of animals in the

laboratory; here the adaptations which make certain organisms suited to particular habitats will be studied. The records made in the field will form the basis for written reports, and reading will be required. In the conferences, the relation of observations to general problems will be discussed.

This course will attempt to give an intimate knowledge of outdoor life, to make one at home with invertebrates in the field. Exact methods will be used in making observations, and an effort will be made to correlate the facts observed with the general principles of biology. Four half days of field or laboratory work, and one or two hours devoted to conference or lecture weekly. *Four hours credit.* ASSISTANT PROFESSOR SMITH.

3.* *The Natural History of Birds.*—Birds will be studied with especial reference to their environment. Field work will include identification, observations on habitat preferences, food habits, nestling activities, and the early autumnal migration movements. In the conferences attention will be given to the economic relations of birds to man, their seasonal distribution and the facts and theories of their annual migration movements. The bird fauna is abundant and includes many representatives of northern species. Two half days of field work and one conference weekly. *Two hours credit.* PROFESSOR SMITH and MR. DEXTER.

4.* *The Natural History of Insects.*—The insects of the region will be collected and identified and field studies made of their relations to environment and their meaning in the biology of the region. An opportunity will be afforded to become familiar with the literature of entomology and to form individual collections of properly determined specimens. Such collections should be of great value to teachers. Two half days of field work and one conference weekly. *Two hours credit.* PROFESSOR SMITH and MR. WELCH.

5. *Individual Course. Special and Research Work in Evolution and Behavior.*—This course does not involve formal instruction but is intended for those who wish to take up special work or to do research under direction.

* Instruction in these courses will be given by the assistants under the general supervision of Professor Smith.

Studies may be made in animal behavior, in the meaning of color in its relation to environment, in mimicry, and the like. A number of problems in these fields have been already outlined and are awaiting solution. *Two, four, six, or eight hours credit.* PROESSFOR REIGHARD.

6. *Systematic and Faunal Zoölogy.*—The identification and classification of special groups of animals and their distribution in the Douglas Lake region.

a. *The Fishes.* PROFESSOR REIGHARD.

b. *The Oligochetes.* ASSISTANT PROFESSOR SMITH. *Two, four, six, or eight hours credit.*

Those having special problems that they wish to investigate should communicate with the Director of the Station concerning literature, apparatus, and material.

BOTANY.

1. *Field and Forest Botany.*—This course will be made of especial interest to those students who desire an acquaintance with the life and habits of plants in their natural surroundings, and with the correlation between the environment and the structure of the plant. The work will consist of field trips, laboratory exercises, and lectures. In the field the student will become familiar with the commoner trees, herbaceous plants and ferns of the vicinity, and with the plant associations in which they grow. The various factors influencing the distribution of plants and their grouping into definite associations will be considered as fully as the time will allow. The effect on the vegetation of certain external factors, such as the water content of the soil, the topography, and the light, will be studied. The topography of the region is so varied that a wide range in ecological factors is produced, and consequently a large number of habitats with varied flora is available for study. In the laboratory, a study will be made of the structure of some plants of the region, with chief attention to the relation between the form of the plant and the environment in which it lives. The lectures will consist of a presentation of the general principles of plant ecology, as illustrated in the vegetation of the vicinity. Four half days work in the field or laboratory and one conference weekly. *Four hours credit.* ASISTANT PROFESSOR GLEASON, MR. LOEW.

2. *Systematic Botany.*—The chief aim of this course it to acquaint the student with the flora about the camp. The general principles of the classification of the higher plants will be considered with special reference to the local flora. The flora is very rich in species and family types. There is an excellent opportunity for the collection and preparation of material for the herbarium. It is desired that students electing this course should have some previous experience, however slight, in the identification of plants. Two half days field work and one conference weekly. *Two hours credit.* Assistant Professor Gleason.

3. *Individual Course: Special and Research Work.*—Students who have taken either of the two preceding courses, or their equivalent, will find at the station excellent opportunities for further study or research in many lines of botany. In every case students will receive individual direction and assistance as needed, and the nature of the work will be adapted to the personal need of the student. Those students who are beginning research in the field will normally devote one day per week to an introductory study of field methods. Practice will be given in the recognition of plant associations, the determination and description of their structure and successional relations, and the measurement of some environmental factors. Such students may also devote one day or more per week to some individual problem. Those students who have had experience in field methods may give their time entirely to special problems. For the graduate, conditions are very favorable for study or research in various lines of ecology. For the undergraduate, there is a wide range of available subjects for study, sufficient to meet the individual tastes of every student. A list of subjects suggested for research during the summer of 1912 will be sent on application. *Two, four, six, or eight hours credit.* Assistant Professor Gleason.

PHOTOGRAPHY.

While no formal course in photography is offered, a number of lectures and demonstrations dealing with pho-

tographic apparatus and processes will be given by Miss Dunbar and will be open to all students. A well equipped dark doom is provided, and all students will be given such individual assistance as they may need. The station is provided with a camera of the usual form, a reflecting camera and a unique apparatus for sub-aquatic photography. Although students may use the station apparatus for scientific purposes, they should bring their own cameras for other uses. Those exceeding 5 x 7 size are not suitable for the field and the best size is probably 4 x 5. Daylight developing outfits for films are to be preferred.

NATURE STUDY.

No formal instruction will be given in the subject matter of nature study, but it is the purpose of the station to bring the student into the closest possible contact with out-door nature. It is believed that teachers of nature study will find this the best preparation.

ASTRONOMY.

The weather is usually favorable for astronomical observations and much may be learned by the use of field glasses or with the unaided eye. Assistant Professor Gleason will give instruction on one evening of each week to those who wish it. The knowledge gained is of much practical use.

MEDICAL ATTENDANCE.

No illness has yet occurred among students at the station and none is expected. A physician is in residence at the camp and his services are free to students. Instruction will be given in first aid to injured and in resuscitation of the apparently drowned.

EVENING LECTURES.

Each Wednesday evening an illustrated lecture will be given by a member of the staff or visiting naturalist.

EXCURSIONS: CAMPING PARTIES.

Students may arrange Saturday excursions to the points of scientific, historical, and scenic interest that lie on every side. Such excursions afford opportunities to the student to broaden his knowledge of natural history and to collect natural history objects. Excursions to nearer points by boat and on foot will form a regular part of the work of the station. Camping parties are sent out at each week end and an opportunity is afforded every student to join one of these parties. Instruction in camping and woodcraft is given to each party by an experienced person. These are arts useful in many natural history investigations.

RECREATION.

Recreation will not be permitted to interfere with the regular work of the Station, but when the day's work is done, opportunities for boating, swimming, and fishing are to be found on every side. Those who wish will be given instruction in swimming and boating. The location of the station in the midst of the northern wilderness and within the circle of Northern Michigan resorts makes it possible to *combine with study the pleasures of a summer outing in an invigorating climate.* At the close of each of the previous sessions every student testified that, while he had gained in his studies as much as would have been possible at a regular university seat, he had at the same time improved in health. Many who had come to the station jaded by a year of teaching left it as much rested as though they had given the whole time to recreation alone.

PUBLICATION.

The instruction offered is along the lines of the published researches of the members of the teaching staff, and students will receive every encouragement to take up work that may yield results suitable for publication. Every assistance will be given in preparing matter for publication and in placing it in suitable scientific journals.

The University Bulletin is Issued by the University of Michigan as Often as Every Six Weeks During the University Year.

Entered as Second-Class Matter at the Postoffice at Ann Arbor, Michigan.

The Bulletin Includes the Following Publications:—

The Annual Report of the President.

The Calendar of the University.

The Annual Announcements of the Department of Literature, Science, and the Arts, the Graduate School, the Departments of Engineering, of Medicine and Surgery, and of Law, the School of Pharmacy, the Homœopathic Medical College, the College of Dental Surgery, and the Summer Session.

Other Announcements of the several departments of instruction, Reports of University officers, etc.

THE ANN ARBOR PRESS

C
M 058u Zbis.
1913

UNIVERSITY BULLETIN

NEW SERIES, VOL. XIV, NO. 12. MARCH, 1913

SEP 1 8 1913

UNIVERSITY OF MICHIGAN
SUMMER SESSION

ANNOUNCEMENT

FOR THE

BIOLOGICAL STATION

EIGHT WEEKS, JULY 1—AUGUST 22

FIFTH SEASON, 1913

Ann Arbor
PUBLISHED BY THE UNIVERSITY
1913

STAFF OF INSTRUCTION

Jacob Reighard, Ph.B., *Professor of Zoölogy and Director of the Zoölogical Laboratory and the Zoölogical Museum in the University of Michigan, Director of the Biological Station* (not in residence).

Henry Allan Gleason, Ph.D., *Assistant Professor of Botany and Curator of the Phanerogamic Herbarium in the University of Michigan, Acting Director of the Biological Station and Assistant Professor of Botany.*

Frank Smith, A.M., *Associate Professor of Zoölogy in the University of Illinois, Assistant Professor of Zoölogy.*

Max Mapes Ellis, Ph.D., *Instructor in Biology in the University of Colorado, Instructor in Zoölogy.*

Harry Nichols Whitford, Ph.D., *Instructor in Botany.*

Paul Smith Welch, A.M., *Fellow in Zoölogy in the University of Illinois, Instructor in Entomology.*

Guy West Wilson, A.M., *Research Assistant in Botany.*

Bessie Rose Green, A.M., *Assistant in Zoölogy in the University of Illinois, Research Assistant in Zoölogy.*

Margaret Vara Cobb, A.B., *Fellow in Zoölogy in the University of Illinois, Research Assistant in Zoölogy.*

James Stephen Compton, A.M., *Professor of Biology in Eureka College, Assistant in Ornithology.*

Alvalyn Eunice Woodward, M.S., *Fellow in Zoölogy in the University of Michigan, Assistant in Zoölogy.*

Frances Jewett Dunbar, A.B., *Assistant in Zoölogy in the University of Michigan, Assistant in Zoölogy.*

Marion Durbin Ellis, A.M., *Dean of Women.*

THE BIOLOGICAL STATION OF THE UNIVERSITY OF MICHIGAN

A Station for Instruction and Research in Biology will be maintained by the University of Michigan, for the fifth season, as a part of its regular Summer Session, during the eight weeks from July 1 to August 22, inclusive, 1913.

LOCATION.

The Station is located near the Bogardus Engineering Camp of the University on a tract of about 1,666 acres of land owned by the University and stretching from Douglas Lake to Burt Lake in Cheboygan County, Michigan, 17 miles south of the Straits of Mackinac. This region, diversified by hills and valleys, was formerly covered by forests of hardwoods and conifers. Small tracts of the former still remain. It contains many lakes of clear water, unsurpassed in the state for size, depth, and beauty of setting. The elevation of the camp, between one and two hundred feet above Lake Michigan, insures cool nights and makes the location favorable for hay fever sufferers.

Six miles to the west of the camp on the Grand Rapids and Indiana Railway is the nearest railway station, Pellston, a town of some 1,300 inhabitants with a bank and a variety of retail establishments. Fifteen miles to the northeast is Cheboygan on the Michigan Central Railway. A state road connects these points and passes near the station. Except for two small summer resorts on Douglas Lake the region for miles about is almost uninhabited. Douglas Lake is two and one-half miles wide and nearly four miles long. Its shores are every-

where wooded, in some places low and receding, in others rising in terraced bluffs 70 feet above the lake. The beach is of clean sand and the sandy lake bottom slopes gradually into deep water, affording ideal conditions for bathing and boating.

The Biological Station lies in the centre of a circle of the famous summer resorts of northern Michigan. In clear view from the highest terrace of the Station and a mile and a half to the south is Burt Lake, much larger than Douglas Lake and one of the chain of lakes and rivers which form the celebrated "Inland Route" from Petoskey on Lake Michigan to Cheboygan on Lake Huron. Thousands of tourists traverse this route every summer and are charmed as the little steamer which carries them passes alternately through narrow, tortuous streams and broad stretches of open lake. Of the summer resorts on the Inland Route, Topinabee on Mullet Lake is best known and is a station of the Michigan Central Railway 8 miles from the Station.

A drive of 12 miles from the camp to the west over the state road brings one to the resort region of Petoskey, Bay View, Harbor Springs, and Harbor Point on Little Traverse Bay, while some 20 miles west of Petoskey is Charlevoix on Lake Michigan. Seventeen miles north of Pellston on the Straits of Mackinac is Mackinaw City, from which a ferry runs seven miles to Mackinac Island, in historical association and scenic beauty the gem of the Great Lakes region.

The topography of the region immediately about the Station is such as to afford a variety of floral and faunal conditions. The region is characteristically sandy and the home of the ground pines, wintergreen, and trailing arbutus, but there are areas of broad-leaf trees and shrubs with their usual accompaniments in flora and fauna. Deer and foxes occur in the neighborhood. Among forms of especial interest to Zoölogists may be mentioned Lota (the fresh water codfish), Necturus (the

mud puppy), the bald eagle, and the ant-lion. The flora is noted for the number of species of heaths and orchids, including several rare forms. About 550 species of flowering plants are known to occur in the vicinity. A half mile south of the camp is a remarkable gorge which ends abruptly against a bluff some seventy feet high. From the bottom of the bluff there issue numerous springs which yield more than a million gallons of water a day and form a trout stream which follows the gorge to Burt Lake. This gorge is several hundred feet wide and its bottom and sides present conditions for a great variety of plants and animals, from water and bog in the stream's path through rich, moist grounds on both flanks to the dry, sandy sides of the ascent.

PLAN OF WORK.

It is not the purpose of the Station to duplicate the work offered at the University, but to provide facilities for field work of a sort that cannot be so well carried on under urban conditions or with the limitations imposed by a university schedule. Instruction is limited to the courses announced, but qualified students may arrange to follow other lines by electing the special courses. A student may give his entire time to either botany or zoölogy or may divide it between these subjects, but no student is permitted to take the work for more than eight hours University credit. Each of the four-hour courses is planned to take one-half the student's time, the two-hour courses, one-quarter; the special courses may take any part or the whole of the time. Although a regular schedule of work is adopted, this is varied whenever the nature of the material or the weather conditions make this advisable. In all courses at least half the time is spent in the field. The work of research students will be arranged in accordance with the nature of the problem selected.

FACILITIES FOR INSTRUCTION.

The necessary scientific equipment for field and laboratory work, launches, row-boats, collecting apparatus, nets, traps, cameras, field glasses, microscopes and accessories, and books are provided by the University. For indoor work there are two log buildings and a tent laboratory.

GRADUATE WORK.

Graduate students, when regularly matriculated in the University and properly registered with the Dean of the Graduate Department, may carry on work at the Station which will count toward an advanced degree.

For full information concerning the requirements for advanced degrees, address the Dean of the Graduate Department, Ann Arbor, Mich.

BOARD AND LODGING.

Tents for the use of students and teaching staff are pitched near the Bogardus Camp. Mrs. Marion D. Ellis, Dean of Women, has general supervision of the women's quarters, and is ready at any time to advise women students. Each tent, 14 x 14 ft., accommodates four persons and is covered by a fly, provided with a wooden floor and equipped with a stove, mosquito bed-canopies, pail, tub, washstand, pitcher, bowl, table, chairs, and straw-filled bed ticks. Students will provide their own towels and bedding, and those who prefer to do so may bring their own tents. All tents must be pitched in accordance with the regulations of the Bogardus Camp and will be subject to daily inspection.

First-class table board is provided at the Mess Tent of the Bogardus Camp, and students are not permitted to cook their own meals.

A list of the articles of clothing, bedding, and other necessities for the work, with instructions for reaching the camp and directions concerning registration and the

payment of fees, will be sent in due time to those students who are accepted.

FEES AND EXPENSES.

Students, except as below, will pay the regular Summer Session fee of $20.00 for the eight weeks and will then be entitled to take courses aggregating eight hours university credit. A charge of $8.00 is made for the use of the scientific equipment. A further charge of $8.00 is made to those students who use the tents provided by the Station. Students may, however, provide their own camp equipment, of such sort as they may choose. Board at the Bogardus Camp Mess Tent is provided at cost, about $4.10 per week.

Students not graduates of the University of Michigan who enroll in the Graduate Department will pay, in place of the above fee of $20.00, a fee of $25.00. This fee of $25.00 includes the regular matriculation fee of the University and the fee for the current summer.

Low round-trip rates from any point in the United States to Pellston or Mackinac Island may be purchased over all railroads and are good for the summer season. The round-trip rate from Ann Arbor to Pellston is $8.75.

REGISTRATION.

Since the number of students that can be accommodated is limited, *immediate registration is necessary to insure admission and no registration will be accepted if received after June first.* Applications for admission should be addressed to Professor T. E. Rankin, Secretary of the Summer Session, Ann Arbor, Mich., and should indicate the courses that the student intends to pursue, his preparation for them, and whether he will bring his own camp equipment or use that provided by the Station. Inquiries concerning the instruction, equipment, or research at the Station may be addressed to the Acting Director or to the instructor in charge of the course.

General View of the Laboratory

A Clean Dive from the Spring-board

Off for th
in Tow of

A Standard Living-tent

LDINGS, AQUARIUM SHED, AND DOCK.

AY'S WORK
: LAUNCH

INTERIOR OF MESS TENT

SHORE OF DOUGLAS LAKE AT THE STATION

1. *The Natural History of Vertebrate Animals, with special reference to behavior and evolution.*—The course deals chiefly with fishes, amphibians, and reptiles, but not with birds (see Course 3), and only incidentally with mammals. As far as possible the forms occurring in the region are collected and identified and their habits studied in the field and laboratory. Students thus learn to recognize many of the native vertebrates at sight. In the field special attention is given to methods of work. The exact methods of the laboratory are applied to the observation of animal habits and to the making of field records. The records made in the field form the basis of written reports, reading is required, and conferences are held for the discussion of the relation of the observations to the general problems of animal behavior, evolution, and taxonomy.

An attempt is made to give to teachers and others a certain measure of intimacy with living animals out of doors. At the same time precise methods of observation, record, and interpretation are utilized for scientific ends. Two half days of field or laboratory work and one conference weekly. *Two hours credit.* Dr. Ellis.

2. *The Natural History of Invertebrate Animals.*—The protozoans, sponges, coelenterates, rotifers, bryozoans, worms, crustaceans, and molluscs of the region are studied. Both aquatic and terrestial invertebrate animals are collected and identified, so that students will gain a general familiarity with them and learn to recognize the common species at sight. Especial attention is given to exact methods of field observations and to the making of field records. The principles of fresh water biology are studied, and practice is given in the use of such apparatus as plankton pumps and nets, the thermophone, thermometer and turbidimeter. The field work is supplemented by a more detailed examination of ani-

mals in the laboratory; here the adaptations which make certain organisms suited to particular habitats are studied. The records made in the field form the basis for written reports, and reading is required. In the conferences, the relation of observations to general problems is discussed.

This course attempts to give an intimate knowledge of outdoor life, to make one at home with invertebrates in the field. Four half days of field or laboratory work, and one or two hours devoted to conference or lecture weekly. *Four hours credit.* Assistant Professor SMITH.

3. *The Natural History of Birds.*—Birds are studied with especial reference to their environment. The field work includes identification, observations on habitat preferences, food habits, nestling activities, and the early autumnal migration movements. In the conferences attention is given to the economic relations of birds to man, their seasonal distribution, and the facts and theories of their annual migration movements. The bird fauna is abundant and includes many representatives of northern species. Two half days of field work and one conference weekly. *Two hours credit.* Dr. ELLIS and Mr. COMPTON.

4. *The Natural History of Insects.*—This course is intended to give the student a general acquaintance with the insects of the region and to afford opportunity for the study of the various forms in their native habitats. Field studies are made of the life histories, habits, and activities of insects belonging to various orders. Emphasis is placed upon the relation of insects to their environment, and their economic relations are also considered. Some work on the morphology and physiology of insects is included. Opportunities are especially good for the study of aquatic forms, and considerable time is devoted to them. In connection with the field work attention is given to the methods of making accurate observations and the proper recording of the same. In-

struction is given on the approved methods of collecting and preserving insects in all stages of development. Collections are made in each of the various habitats, and the material identified in the laboratory. Opportunity is afforded to form individual collections of properly determined specimens which should be of considerable value to teachers. The identification of immature forms is included in the systematic work. Familiarity with the available entomological literature is encouraged. Two half days of field and laboratory work and one conference weekly. *Two hours credit.* Mr. WELCH.

6. *Special and Research Work in Zoölogy.*—This course does not involve formal instruction, but is intended for those who wish to take up special work or to do research work under direction. Students qualified to work independently may choose problems to meet their individual needs. Such students register under Dr. Ellis, who has general supervision of zoölogical research. Students who are beginning research, or who work under direction are recommended to choose subjects in the following fields:

a. *The Fishes or Sporozoa.* Dr. ELLIS.
b. *The Oligochetes or Fresh-water Sponges.* Assistant Professor SMITH.
c. *The Insects.* Mr. WELCH.

Two, four, six, or eight hours credit.

BOTANY.

1. *Field and Forest Botany.*—The work of this course is designed to give the student a general familiarity with the plant life of the region, with the names and habits of the commoner species, and with the correlation between their habits and structure. The work consists chiefly of field trips, supplemented by laboratory exercises and lectures. In the field the student becomes familiar with the trees, the shrubs, the aquatics, the ferns,

the insectivorous plants, the orchids, and some of the herbaceous plants of the region, and with the plant associations in which they grow. The effect on the vegetation of certain external factors, such as soil, water, and light, the adaptation of plants to winter conditions, the cross pollination of flowers by insects, the dissemination of seeds, and other similar subjects are demonstrated. In the laboratory a study is made of the structure of some plants, with chief attention to the relation between the form of the plant and the environment in which it lives. Four half days work in the field or laboratory and one conference weekly. *Four hours credit.* Dr. WHITFORD.

2. *Systematic Botany.*—The chief aim of this course is to acquaint the student with the flora about the camp. The general principles of the classification of the higher plants are considered with special reference to the local flora. The flora is very rich in species and family types. There is an excellent opportunity for the collection and preparation of material for the herbarium. It is desired that students electing this course should have some previous experience, however slight, in the identification of plants. Two half days field work and one conference weekly. *Two hours credit.* Assistant Professor GLEASON.

3. *Ecology.*—This course serves as a general introduction to ecological field work and the methods of ecological research, with particular reference to the study of plant associations. Practice is given in the recognition of associations, the determination and description of their structure and successional relations, and the measurement of some environmental factors. Particular attention is given to the dynamic factors of the environment, to their effect on the present structure and future development of the plant community, and to the role of the individual plant in promoting or retarding these effects. Because of the large number of associations in

the region, it is impossible to study more than the most important ones. These include the aspen association, the hardwood forest, the tamarack and sphagnum bog, the arbor-vitae bog, and the sand dunes, lagoons, and beaches along the lake shore. The course is open only to students who have taken Courses 1 or 2 in the Biological Station, or have had equivalent botanical experience elsewhere. Two half days of field work and one conference weekly. *Two hours credit.* Assistant Professor GLEASON.

4. *Special and Research Work in Botany.*—Students who have taken Courses 2 or 3, or have had adequate botanical experience elsewhere, will find at the Biological Station excellent opportunities for further study or research in many lines of botany. Undergraduates, or graduates beginning research and consequently needing personal direction, are advised to choose a problem along ecological or systematic lines. Advanced students or independent investigators are free to choose problems in any line of botany, and every effort is made to provide them with the necessary facilities and equipment for their work. A list of subjects suggested for investigation in 1913 will be sent on application. *Two, four, six, or eight hours credit.* Assistant Professor GLEASON.

PHOTOGRAPHY.

While no formal course in photography is offered, the camera is used in class work in many courses, and the student has an excellent opportunity to become familiar with the methods and uses of photography for scientific work. A well equipped dark-room is provided and may be used by students. The station is provided with a camera of the usual type, a reflecting camera, and a unique apparatus for sub-aquatic photography. Although students may use the station apparatus for scientific purposes, they should bring their own cameras for other uses. Those exceeding 5 x 7 size are not suitable for

the field, and the best size is probably 4 x 5. Daylight developing outfits for films are preferred. The student should bring enough films or plates to last the whole season.

NATURE STUDY.

No formal instruction is given in the subject matter of nature study, but it is the purpose of the station to bring the student into the closest possible contact with out-door nature. It is believed that teachers of nature study will find this the best preparation.

MEDICAL ATTENDANCE.

No illness has yet occurred among students at the station and none is expected. A physician is in residence at the camp and his services are free to students. Instruction is given in first aid to injured and in resuscitation of the apparently drowned.

EVENING LECTURES.

A series of illustrated evening lectures on popular scientific subjects is given by members of the staff or by visiting naturalists.

EXCURSIONS: CAMPING PARTIES.

Some practical experience with woodcraft and camping is considered not merely desirable, but almost essential to the field naturalist. To this end, students are encouraged to arrange Saturday excursions to the points of scientific and scenic interest that lie on every side. Such excursions afford opportunities to the student to broaden his knowledge of natural history and to collect scientific specimens. Excursions to nearer points by boat and on foot form a regular part of the work of the station. Camping parties may be sent out each week end

and an opportunity is afforded every student to join one. On them, instruction in camping, cooking, and woodcraft is given by an experienced person.

During the past two years, a four-day walking trip, under the direction of a member of the staff, has been one of the features of the station. It is limited to eight men, who must be physically adapted to carrying the necessary packs.

RECREATION.

Recreation is not permitted to interfere with the regular work of the Station, but when the day's work is done, opportunities for boating, swimming, and fishing are to be found on every side. The location of the station in the midst of the northern wilderness and within the circle of Northern Michigan resorts makes it possible to *combine with study the pleasures of a summer outing in an invigorating climate.* At the close of each of the previous sessions every student testified that, while he had gained in his studies as much as would have been possible at a regular university seat, he had at the same time improved in health. Many who had come to the station jaded by a year of teaching left it as much rested as though they had given the whole time to recreation alone.

PUBLICATION.

The instruction offered is along the lines of the published researches of the members of the teaching staff, and students will receive every encouragement to take up work that may yield results suitable for publication. Every assistance will be given in preparing matter for publication and in placing it in suitable scientific journals.

Entered as Second-Class Matter at the Postoffice at Ann Arbor, Michigan.

THE ANN ARBOR PRESS—PRINTERS